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## WHAT IS CLAIMED IS:

1. A polypeptide comprising in the amino-terminal to carboxy-terminal direction:

- (a) a first polypeptide segment, wherein said first polypeptide segment has membrane anchoring properties; joined to
- (b) a second polypeptide segment having a sequence selected from the group consisting of residues 75-114 of SEQ ID NO:12 and residues 75-114 of SEQ ID NO:14; joined to
- (c) a third polypeptide segment having at least 40% sequence identity to residues 115-506 of SEQ ID NO:4.
- 2. The polypeptide of claim 1, wherein said third polypeptide segment has at least 50% sequence identity to residues 115-506 of SEQ ID NO:4.
- 3. The polypeptide of claim 2, wherein said third polypeptide segment has an aspartic acid at the position corresponding to amino acid 307 of SEQ ID NO:4.
- 4. The polypeptide of claim 3, wherein said polypeptide has the amino acid sequence of SEQ ID NO:20.
- 5. The polypeptide of claim 3, wherein said polypeptide has the amino acid sequence of SEQ ID NO:22.
- 6. The polypeptide of claim 3, wherein said polypeptide has the amino acid sequence of SEQ ID NO:34.
- 7. The polypeptide of claim 3, wherein said polypeptide has the amino acid sequence of SEQ ID NO:36.

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- 8. The polypeptide of claim 1, wherein said polypeptide catalyzes the condensation of malonyl CoA and a C18 fatty acyl substrate, leading to the synthesis of a C20 fatty acyl CoA.
- 9. The polypeptide of claim 8, wherein said C18 fatty acyl substrate is an oleoyl substrate.
- 10. The polypeptide of claim 1, wherein said polypeptide catalyzes the condensation of malonyl CoA and a C20 fatty acyl substrate, leading to the synthesis of a C22 fatty acyl CoA.
- 11. The polypeptide of claim 10, wherein said C20 fatty acyl substrate is an eicosenoyl substrate.
  - 12. A nucleic acid encoding the polypeptide of claim 1.
  - 13. A nucleic acid encoding the polypeptide of claim 2.
  - 14. A nucleic acid encoding the polypeptide of claim 3.
  - 15. Host cells containing a nucleic acid encoding the polypeptide of claim 1.
  - 16. Host cells containing a nucleic acid encoding the polypeptide of claim 2.
  - 17. Host cells containing a nucleic acid encoding the polypeptide of claim 3.
  - 18. The host cells of claim 15, wherein said host cells are yeast cells.
  - 19. The host cells of claim 15, wherein said host cells are plant cells.

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20. A plant containing an exogenous nucleic acid encoding the polypeptide of claim 1.

- 21. A plant containing an exogenous nucleic acid encoding the polypeptide of claim 2.
- 22. A plant containing an exogenous nucleic acid encoding the polypeptide of claim 3.
  - 23. The plant of claim 20, wherein said plant is Brassica napus.
  - 24. The plant of claim 21, wherein said plant is Brassica napus.
  - 25. The plant of claim 22, wherein said plant is Brassica napus.